

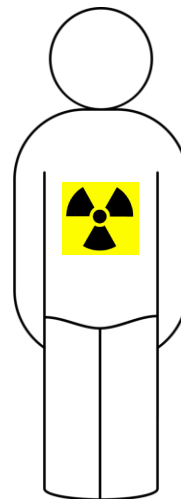
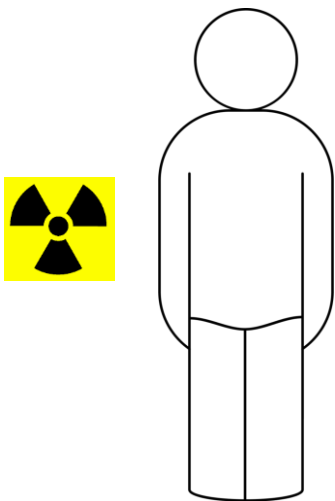


Perspective on Internal Contamination and Dose

Hanford Internal Dosimetry Program

What is meant by contamination and dose?

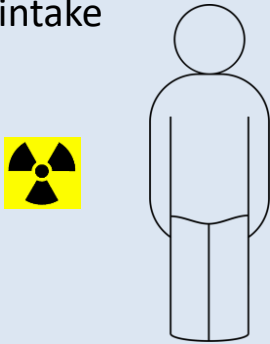
Contamination: the unwanted presence of radioactive material.



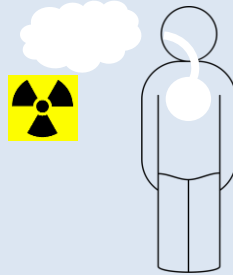
Dose: energy deposited in the body by radioactive decay of contamination

External and Internal Sources

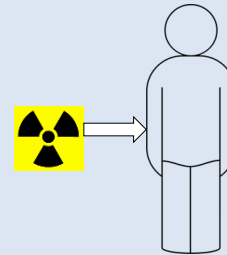
External exposure:
no intake



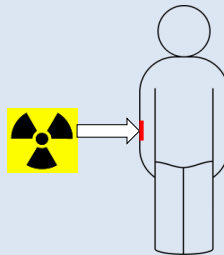
Route of intake:
inhalation



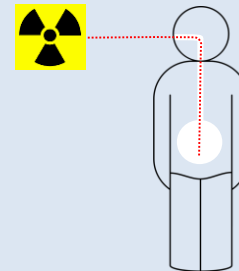
Route of intake:
skin absorption



Route of intake:
wound exposure



Route of intake:
ingestion



Measuring External Dose

Dosimeters measure dose from external sources.



Left: Hanford standard dosimeter



Left: Hanford combination neutron dosimeter

Below: Hanford extremity dosimeter



Dose from internal contamination (within the body)
cannot be measured by dosimeters.

External Dose vs. Internal Dose

External Dose

- Generally, easy to measure with a dosimeter
- Usually reported as a “whole body” or “effective” dose

Internal Dose

- Requires determination from bioassay measurements of material in the body or excreted from the body
- Type of bioassay depends on radioactive material
- Optimum type of bioassay depends on radioactive material and time since intake occurred

Bioassay Methods

There are several bioassay methods used to determine intake and internal dose:

- Whole body exam/count
- Chest count
- Wound count
- Urine/fecal sample analysis



Left: a whole body count and lung count being taken



Left: the in-home kit for collecting urine or fecal samples for bioassay

How Critical is Time to Bioassay?

Don't sample too soon... but don't wait too long

- The material may not be present in the bladder or bowel if the sample is taken too soon.
- Dose detection capability varies with time after intake. Getting a bioassay at the right time can provide a more accurate analysis.

Internal Dosimetry Process

1. Obtain bioassay measurements
2. Investigate abnormal results with follow-up measurements.
3. Evaluate the measurements using computer models to address the many variables in the dose calculation process.
4. Calculate an effective dose to the whole body considering doses received by various organs and the time material remains in those organs and the whole body.

Evaluation Considerations

- Intake date
- Intake circumstances
- Particle size (for inhalation)
- Radionuclide(s)
- Chemical solubility
- Time to bioassay
- Reference person model
- 50-year dose calculation

When do the results come back?

Bioassay results

- Whole body / lung counts – 1 day
- Fecal or urine sample analysis – 2 to 6 weeks

Bioassay results are reported to contractor's dosimetry point of contact

- Dose evaluation – less than 90 days from receipt of final data
- Communication to company – 1 day
- Notification to worker – 2 days

The Dose Report

Evaluation Report for Record

- Data, interpretation and assumptions
- Intake and dose calculation for confirmed intake

Summary Letter from Internal Dosimetry contains

- Why did we do the evaluation
- What data was collected
- What was the conclusion (confirmed intake - yes or no?)
 - No confirmed intake → letter sent directly to worker
 - Confirmed intake → letter sent to company's dosimetry point of contact who will then contact the worker

Summary letter and the evaluation report are permanently retained in worker's personal radiation exposure file

External vs. Internal Exposure

External Exposure

- Source outside the body
- Dose from exposure stops when you move away from the source
- Time, distance and shielding used to protect
- ALARA

Internal Exposure

- Contamination source enters the body
- Depending on type of intake, material behaves differently internally
- Some materials may pass through the digestive system with very little absorption
- Some materials may be retained in the lungs, absorbed into the blood and carried to cells

Scale of Radiation Levels

Federal regulations mandate that worker dose does not exceed an annual limit of 5,000 mrem.

DOE administrative controls puts a worker's annual dose limit at 2,000 mrem.

Hanford administrative controls put the annual dose limit at 500 mrem for its radiological workers.

Federal regulations mandate that members of the public accessing DOE facilities do not receive a dose of more than 100 mrem annually.

